Aus der dermatologischen Klinik der Universität Bern
(Direktor: Prof. Dr. med. H. Kuske)

Experimental Evaluation of Protective Skin Creams

Inaugural-Dissertation

zur Erlangung der Doktorwürde
der Medizinischen Fakultät der Universität Bern

vorgelegt von

Murray Klayman
von New York (USA)

Bern 1956

Aus der dermatologischen Klinik der Universität Bern
(Direktor: Prof. Dr. med. H. Kuske)

Experimental Evaluation of Protective Skin Creams

Inaugural-Dissertation

zur Erlangung der Doktorwürde
der Medizinischen Fakultät der Universität Bern

vorgelegt von

Murray Klayman
von New York (USA)

Buchdruckerei Akerets Erben, Dielsdorf

R. UNIV.
BIBLIOTHEK

Von der Medizinischen Fakultät auf Antrag
des Herrn Prof. Dr. H. Kuske zum Druck als Dissertation genehmigt.

Bern, den 2. März 1956.

Der Dekan der Medizinischen Fakultät:
Prof. Dr. W. Wilbrandt.

Introduction

Industrial skin diseases form a large percentage of the occupational diseases for which compensation is paid (Switzerland 56 %, USA 70 % - [Schwartz], Great Britain 35 % - [Horner]). This difference is more apparent than real in that compensation laws differ. Occupational dermatoses include 20 % of all skin diseases (Oppenheim) and 1/3 of these are Eczema cases. C. Knowles estimates similar results. Gardinier can trace of 1194 Eczema cases 870 cases are due to occupational causes (68 %). Lane states that 10—12 % of all dermatoses are caused by factors in the occupation and 65 % of all occupational diseases are dermatoses.

Industrial dermatoses not sufficiently severe to come under the compensation laws occur even more frequently. Surveys show that about 1 % of all factory workers can be found with occupational dermatoses during an inspection (Schwartz).

Causes of Occupational Dermatosis

The causes of occupational dermatoses can be classified into 5 main groups. Theses are according to Bzowski and Schwartz:

1. Mechanical — friction, pressure, trauma
2. Physical — heat, cold, sunlight, electricity, x-rays
3. Chemical — organic and inorganic
4. Poisonous plants
5. Biologic agents: bacteria, fungi, parasites.

By far the principal cause of industrial dermatoses are caused by the chemical agents. The response of sensitive workers to the specific chemical irritant can be divided into two main groups. One group forms dermatoses arising by chemical injury without a special disposition being necessary for the manifestation of the disease. The other group requires a special disposition and immune-biological process for the appearance of the skin disease.

These industrial irritants specifically inflame the skin by means of (1) a direct corrosive and destructive action on epithelium, e. g.

caustic soda, concentrated acids (alkalis tend to dissolve the keratin protective layer, acids in low dilution are far less capable of attacking keratin), (2) fat-solvent action, e. g. naphtha and oil/water lubricant dermatitis, in which the emulgent used to stabilize the emulsion increases the subsequent detergent and therefore irritative action of soaps, (3) blockage of the sebaceous glands by action on epithelial lining, on fat content, or by physical obstruction of exrection, followed by secondary infection, (4) irritative action on unbroken skin with localized hyperkeratosis and (5) an allergic reaction.

The prevention of industrial skin diseases plays a large role in occupational medicine. The best preventive measures are those hindering contact of potential irritants with the skin. Therefore, there are certain responsibilities in saftey engineering wich the management should undertake to control the appearance of industrial skin diseases in its workers, and there are responsibilities the worker should assume in prophylaxes. Managerial saftey engineering ought to include (1) education of worker, (2) totally enclosed processes, (3) general ventilation of workrooms, (4) special suction vents to carry away irritant dusts, vapours, and gases, and (5) supplying materials with which the worker can help himself as protective skin creams, gloves, protective clothing, and adequate wash facilities. The most important personal protective measure by the worker is cleanliness. This includes not only personal hygiene but environmental cleanliness as well (floors, walls, ceilings, windows, and machines). All measures by the worker as adequate washing, wearing protective clothing, and using protective ointments help to keep the harmful noxa from his skin.

Protective creams

Special protective creams are not as efficient preventives of industrial dermatoses as are protective clothing, washing, or a salve base as Lanette wax (Carrie). However, there may be no other available hindrance to the irritating substances reaching the skin. At least when protective ointments are used, the workers rarely leave the work places without washing after work and offering a degree of protection to noxous substances, are the main roles of protective salves in industry.

The requirements of a protective salve (Klauder, Schwartz, Tara, Hopf) are: (1) non-irritating and non-sensitizing, (2) give actual protection against the irritant, (3) easly applicable to the skin, (4) should adhere to the skin during work and yet be easily removed with non-irritant cleansers after work, (5) should not deteriorate in containers, (6) elastic to allow movements of the hands, (7) not torn or worn away

by using work materials, (8) pleasant in appearance and odour, (9) allow for normal physiological functions of skin as perspiratio insensibilis etc., (10) bacteriostatic, (11) economical, and (12) penetrate the skin.

The protective applicants can be placed into two main classifications; those salves which are water-repellent containing fat, and those salves which are oil-repellent free of fatty ingredients. Each may be divided into wet and dry film types.

The water-repellent salves offer protection against acids, alkalis, and water-soluble irritants. The oil-repellent films give protection against oils, organic solvents, and oil-soluble irritants. The water-repellent oily ointments bearing the properties of softness, high melting point, few solid constituents, and emulsifying well with the skin are best suited.

A list of substances have been proposed by Prof. Dr. T. E. A. Stowell of London in the manufacture of barrier creams. These are: sodium alginate, magnesium silicate, sodium hexametaphosphate, acacia gum, glycerine, saponis alba, pulv. boracis, sodium hydroxide, stearic acid, cholesterol absorption base, spermaceti, cera alba, cetyl alcohol, paraffin liquid, pulv. creta gall., diatomaceous silica (basically silicon dioxide), zinc stearate, pulv. kaolin, zinc oxide, alcohol, phenyl mercuric nitrate, methyl parahydroxybenzoate, colour, tragacanth, cetyl trimethyl ammonium bromide, cetyl stearyl alcohol, cholesterol alcohol, and terra fuller alba.

The industrial salves have been divided by Czetsch-Lindenwald and Hopf into 5 groups based on a physical test of resistance to solvents, chemical analysis, and their own experience.

(1) Oil-H_2O-Emulsion on the basis of vanishing creams (stearate creams) or wax salves containing cetyl alcohol with an acid emulgator of a sulfonated fatty alcohol and a lecithin similar phosphatide. This product containes 20—60 % fatty materials, is not solvent resistant in that gelatinous ingredients are not added to it, and is very economical. The representative type is the day cream of the cosmetic industry.

(2) H_2O-Oil-Emulsion of 30—70 % fatty constituents. This salve almost exclusively containes Adeps lanae (lanolin, wool fat) or concentrates. The salve is no protection against fat solvents.

(3) These salves include the skin-milk emulsions containing 5—15 % fat. These salves are economical, do not protect against solvents, and only fatten. They are composed of an indifferent oil-mostly paraffins.

(4) These salves include the mucilage creams whose basic type is the glycerine salves. These are fat solvent resistant and washable with water.

(5) These preparations include those salves not in the above groups. They are emulgator solvents which dry on the skin and permit the easier cleansing of injurious substances from the skin surface. These protect against fat solvents, and contain organic cellulose esters with an oil or fat of an iodine number less than 125.

To all of the protective skin creams, certain substances may be added in order to incorporate properties necessary to enhance the effect of the main constituents or to make the salve more desireable to the users. Mild alkalis may be added as magnesium oxide to help neutralize acids. Salts such as perborates, peroxides, and permanganates may be added to oxidize and destroy the irritant properties of substances. Titanium oxide can be added in order to make the salves visible. Certain authorities (Czetsch-Lindenwald, Klauder) protest the use of perfumes and strong coloring matter.

The fat removal and alkali producing power of soaps in protective skin creams must be calculated. Normally, the skin surface is fatty and acid. The skin reacts as a buffer since it has the ability to neutralize certain bases. If this ability is overpowered, an effect on the Keratin and other proteins in the Stratum corneum occur. The arising of certains albuminates that take-up water to form a gel produce localized albuminates that take-up water to form a gel produce pitates as insoluble calcium soaps and acts as an irritant. Therefore, the greater the basic quantity present in the productive salves, the stronger will be the caustic effect.

Ideal Protective skin-creams:*

(I) Water-repellent salves

Water repellent salves contain an animal fat as lanolin** (wool fat, Adeps lanae), mineral fat such as petrolatum (soft paraffin), sometimes a vegetable oil as Castor oil, and perhaps a stiffening agent as beeswax, carnuba wax, spermaceti, paraffin wax, etc.

---

* Examples by Schwartz and Czetsch-Lindenwald.

** Klauder, Gross, and Brown describe lanolin as an carcinogenic substance.

Examples:

(a)	Anhydrous lanolin	6,0
	Castor oil	3,0
	Spermaceti	1,0
	Preservative	1,0
(b)	Vaselin	8,0
	Lanolin (Adeps lanae)	1,0
	Titanium oxide	1,0
	Gums	1,0

A water-repellent dry film application consists essentially of a water-soluble resin dissolved in alcohol. Resins are amorphous substances that exude from plants usually formed by the oxidation of volatile oils. Inert powders may be added to reinforce the resin film remaining on the skin after the alkohol evaporates.

Example:

Shellac (resin)	10,0
Isopropyl alcohol	65,0
Talc	13,0
Sodium perborate	10,0
Boric acid	2,0

Marti recommends that a very satisfactory preparation against NaOH is an Alumium gel- cetyl salve composed of aluminium hydroxide 20, aqua dest. 20, concentrated hydrochloric acid 10, and cetylic ointment ad 100.

(II) Oil-repellent salves:

Oil-repellent salves of ointment type consist of water soluble resins (tragacanth, acacia, sodium silicate, Irish moss, sodium alginate, pectin, and methyl cellulose) in a vanishing cream type of base or simply dissolved in H_2O.

Example:

Sodium alginate	5,0	
Tragacanth	5,0	
Stearic acid	20,0	Vanishing-cream base (stearate creams)
Sodium carbonate	2,0	
Glycerin	5,0	
Water	63,0	

Example of oil-repellent dry film:

Acacia	10,0
Borax	2,0
H_2O	88,0

Do to the rising need in Swiss industry for the protection of the employee, various barrier creams were adopted by the industries themselves without the guidance or scientific testing methods of Swiss dermatological authorities. The protective creams were those mainly used in such countries as England and Germany and are widely advertised in Switzerland. Therefore in order to test in retrospect the worth of the barrier creams chosen by Swiss industry, this work was begun.

Personal experiments

Reasons for the investigation:

(1) Do the industrial skin salves (Sternocleanse, Kerodex, and Defensyl protect against the formation of cutaneous manifestations (as eczema) in sensitive individuals caused by exogenous allergens found in industry?

(2) Are these salves in themselves toxic to the worker?

(3) Have the protective skin salves a place in industry as determined from the experimental investigation?

Materials:

Three widely-used industrial skin-protective salves in Switzerland were chosen for investigation.

They are:

1: Sternocleanse: Sternocleanse distributed in Switzerland by L. Hartmann, Winterthur, and manufactured by Sterns Ldt., London. Sternocleanse No. I is advertised to have a pH of 6,0 and to protect the skin against acetone, benzole, carbide, carbon black, carbon tetrachloride, cellulose paints, cement (dry), coal tar, creosote, dopes, dry cleaning solvents, enamels, flour (dry), fruit sprays, fuel oil, fur clippings, glues, greases, lacquers, metal swarf, mineral oils, naphtha, paints, paper pulp, paraffin, petrol, printing inks and greases, rouge powder, shellac, tobacco, trichlorethylene, turpentine, varnishes und white spirit. Sternocleanse No. II is advertised to have a pH of 6,5 and to protect the skin against weak solutions of acids (hydrochloric, nitric, and sulfuric), alcohol, alkali solutions, bakers fluid (soldering), cement (wet), cement for plastics, chlorine, chrome salts, confectionery mixtures, copper sulphate, cyanide, dough mixtures, dyeing solutions, etching fluid, formaldehyde, fruit juices, garden soil, lime (wet), methylated spirits, nylon, oil emulsions (soluble), phenol, photo-

graphic chemicals, plating solutions, rubber emulsions, vegetable peelings, and wood stains (water base).

The composition of Sternocleanse as reported by Sterns Ltd. is soap flakes, talc, fatty acids, glycerine, sorbitol, water, two perfumes, parachlormetacresol, and Biebrich scarlet.

2: Kerodex: Kerodex was developed by Scientific Pharmacals Ltd. in England and is distributed by Turimed A.G., Zürich. This skin-protective cream is available in two series: B.Q. and B.Q.N. The B.Q. series No. 5, 6, 8, 9, 10, 11, and 12, protect against various specified types of irritants present in paints, enamels, tar, oil, creosote, dope, thinners, and solvents. The B.Q.N. series No. 1, 1a, 2, 3, 4, and 7 protect against acids, alkalis, and other irritants soluble in H_2O. No. 1 protective against acids, alkalis, and water-soluble solutions (pH 8), No. 5 protective against petroleum, oils, and fat-soluble solutions (pH 8,3), and No. 12 protective against coal tar, lacquer, and paints are the main standard representative types. No. 5 against fat-soluble substances and No. 1 against water-soluble substances were used in the experiments.

3: Defensyl: Defensyl is manufactured and distributed by Hamol AG, Zürich. Defensyl F is advertised to protect against fat-soluble substances, paints, lacquer, oils, and organic solvents as benzol, xylol, toluol, ether etc. Defensyl W protects against water-soluble substances as acids, alkalis, and other skin irritants.

Methods — Part I:

Patients were chosen for the investigations from the Dermatological Clinic, Inselspital, Bern, under the direction of Prof. Dr. med. H. Kuske. Approximately ½ of the patients tested with the individual skin protective creams were diagnosed eczema cases, and of these eczema cases circa 1/4 or less were sensitive to a specific exogenous allergen as shown by the patch-test. The remaining ½ were patients with diseases unrelated to eczema such as Ulcus cruris, Impetigo and fungus infections.

A. Investigation of skin-salves protective against fats and organic solvents:

I. Patch-test of salve: The patch-test was conducted in the following manner: a 1,0 centimeter square cloth containing a sample of the salve to be tested was applied to the skin. This was covered by a 2 cm^2 cellophane and by a 4 cm^2 skin tape. The patch was removed in 24 hrs. and a reading of the skin area was made imme-

diately after removal and 24 hrs. later. A minimum positive was a significant redness of the area.

II: (a) Patch-test of obligatory irritant petroleum in the concentrations of 75 %, 50 %, and 25 % over pre-treated skin on which salve has been rubbed in for 1 min.

(b) Control Patch-test of obligatory irritant Petroleum 75 %, 50 %, and 25 % over normal skin.

III: Open patch-test: a 2 cm^2 gauze containing the salve to be tested was applied to the skin. Over this was placed a 4 cm^2 lattice-work cloth (Ventilosan) whose edges adhere to the skin by means of skin glue. This allows evaporation of substances to take place.

IV: Patch-test of Specific Allergen (conducted as in II a and b).

V: Attempting to simulate actual use, salve was massaged into an area (app. 15 cm in diameter) for 5 minutes duration two times per day for three days.

The protective skin-salves tested in the manner described were Sternocleanse I on 30 patients, Kerodex BQ series No. 5 on 30 patients, and Defensyl F on 30 patients. Each series of 30 patients included 15 eczema patients and 15 non-eczema patients.

B. Investigation of skin-salves protective against acids, alkalis, and water-soluble substances:

I: Alkali-Resistance Test as originated by Prof. Dr. Burckhardt and applied by Paul Marti in his dissertation.

On the extensor surface of the forearm (or thigh — Regio femoris ventricularis), the hair is removed carefully with a razor, the area washed and dryed and salve was rubbed into the skin of the left extensor surface for 1 minute. Using the right extensor surface as control, the method is repeated omitting salve. Three solid glass blocks (2,0 cm wide, 3,5 cm long, and 1,5 cm deep) were placed transversely fallowing each other in the testing area. Under each glass block was placed 1 drop of fresh N/2 NaOH from a pipette that releases 32—36 drops in 1 min. After 10 min., the glass blocks were removed, the areas gently blotted with gauze, and investigated for a reaction. This method was repeated, but the proximal directed blocks oh the right and left forearms do not take part. The method was repeated again omitting the middle blocks. Therefore, at the end of 30 minutes, there were 3 areas on each forearm to investigate for a reaction. The proximal directed area has had 1 drop of N/2 NaOH,

the middle area has had 2 drops of N/2 NaOH, and the distal directed area has had 3 drops of N/2 NaOH.*

II: Patch-test of specific allergen as described in A II a and b.

III: Salve was massaged into an area (app. 15 cm in diameter) for five minutes duration two times a day for three days.

The protective skin-creams tested in this manner were Sternocleanse II on 30 patients, Kerodex BQN series No. 1 on 30 patients, and Defensyl W on 30 patients.

An attempt was made to standardize all tests. Equal samples of salves, obligatory irritants, and specific allergens were used in all tests. Like tests were carried out on the same skin areas of each patient (all patch-tests were tested on the backs Regio scapularis of patients.

An investigation was attempted to note the effect of the various salves on eczematous skin. However, the experiment was abandoned when observation disclosed all 3 salves caused an acute exacerbation on the first few patients. This demonstrated a discrepancy in the later found non-toxic action of Defensyl in the patch-test and the toxic effect on eczematous skin.

Results — Part I:

The objective data compiled in the work are placed in graphic form.

The data was applied to determine the toxicity, the type of dermatological patients effected by the toxicity (Eczematous cases and non-eczematous cases) and the protectivity of Sternocleanse, Kerodex and Defensyl.

The number of patients tested totaled 30 per salve; one patient has the value of 3,3 %.

The results are divided into 2 parts (A) protective salves against fats and fat-soluble substances, and (B) the protective salves against acids, bases, and water-soluble substances.

Graph I: Graph I is a graph of toxicity of each salve which is divided into two parts. One part is a graph of all positive patch-tests, and the other part is a graph of all positive patch-tests accompanied by a positive open patch-test. Both graphs are based on the total number of cases tested.

Graph II: Graph II shows the type of dermatological patients effected (eczematous patients or non-eczematous patients) by each

* Strong cutaneous reactions caused an immediate cessation of the experiment.

salve. The graph is divided into two parts. One part showing the percent of positives in eczematous patients and the other showing the percent of positives in non-eczematous patients.

Graph III: Graph III is a graph of protectivity for each salve, and is divided into two parts. One part shows the positive protectivity obtained from the total number of positive reactions observed with the obligatory irritants. The second part shows the same principle observed with the specific allergen.

A. Protective salves against fat and fat-souble substances.

Graph I: Toxicity

a) Patch-tests:
   1) Sternocleanse I showed 26 patients toxic
   2) Kerodex 5 showed 21 patients toxic
   3) Defensyl "F" was not toxic.

b) Open patch-tests:
   Sternocleanse I showed 4,0 patients toxic
   Kerodex 5 showed 1,0 patients toxic
   Defensyl "F" was not toxic.

Graph II: Types of Dermatological patients effected (Eczematous patients or non-eczematous patients)

a) Eczematous patients:
   Sternocleanse I effected 14 of the eczematous patients
   Kerodex 5 effected 13 of the eczematous patients
   Defensyl "F" has no toxic effect.

b) Non-eczematous patients
   Sternocleanse I effected 12 of the non-eczematous patients
   Kerodex 5 effected 8 of the non-eczematous patients
   Defensyl "F" has no toxic effect.

Graph III: Protectivity

Against obligatory Irritant:
Sternocleanse I protected 12,0 cases
Kerodex 5 protected 16,0 cases
Defensyl "F" protected 7,0 cases.
Against specific Allergen:
Sternocleanse I protected 6,0 cases
Kerodex 5 protected 8,0 cases
Defensyl "F" protected 3,0 cases.

B. Determinations of protective salves against acids, bases and water-soluble substances:

Graph I: Toxicity

Patch-tests:

Sternocleanse II showed 19,0 patients toxic
Kerodex I showed 4,0 patients toxic
Defensyl "W" has no effect.

Open patch-tests:

Sternocleanse II showed 10,0 patients toxic
Kerodex was not toxic
Defensyl "W" was not toxic.

Graph II: Types of Dermatological patients effected (Eczematous patients or non-eczematous patients)

Eczematous patients:

Sternocleanse II effected 14 of the eczematous patients
Kerodex 1 effected 4 of the eczematous patients
Defensyl "W" has no effect.

Non-eczematous patients:

Sternocleanse II effected 5 of the non-eczematous patients
Kerodex 1 was not effective
Defensyl "W" was not effective.

Graph III: Protectivity

Against obligatory Irritant:

Sternocleanse II protected 17,0 cases
Kerodex 1 protected 18,0 cases
Defensyl "W" protected 7,0 cases.

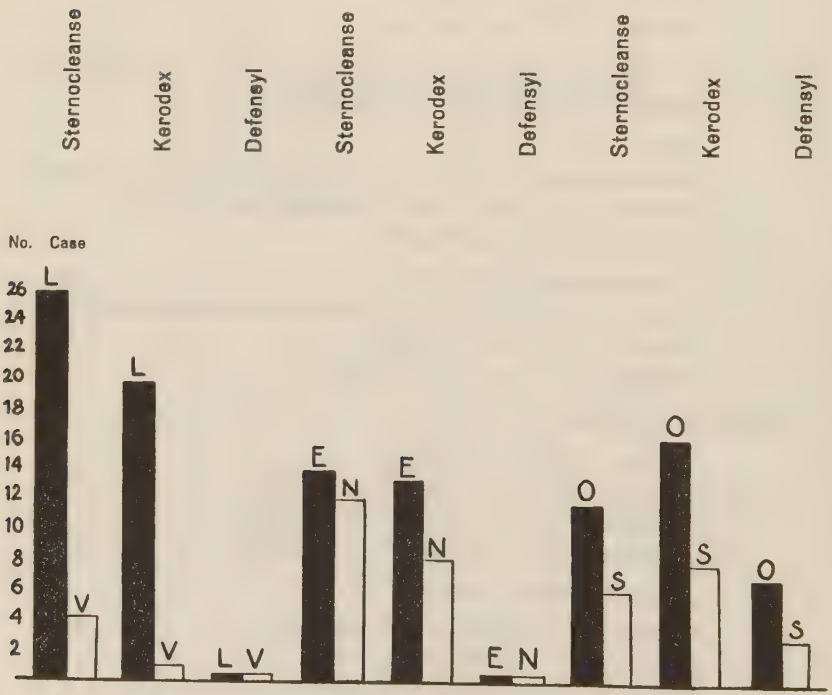
Against specific Allergen:

Sternocleanse protected 8 cases
Kerodex 1 protected 5 cases
Defensyl "W" protected 4 cases.

Note: The patch-tests of the specific exogenous allergen may be negative and distort the curves in Graph III für the fellowing reasons: (1) The conditions under which the skin was sensitized was not reproduced, (2) the patient may not be sensitive to the suspected allergen at the time of testing, and (3) the skin may be to thick for the penetration of the allergen in the given time allowed.

A. Protective salves against Fats and Fat-soluble substances.

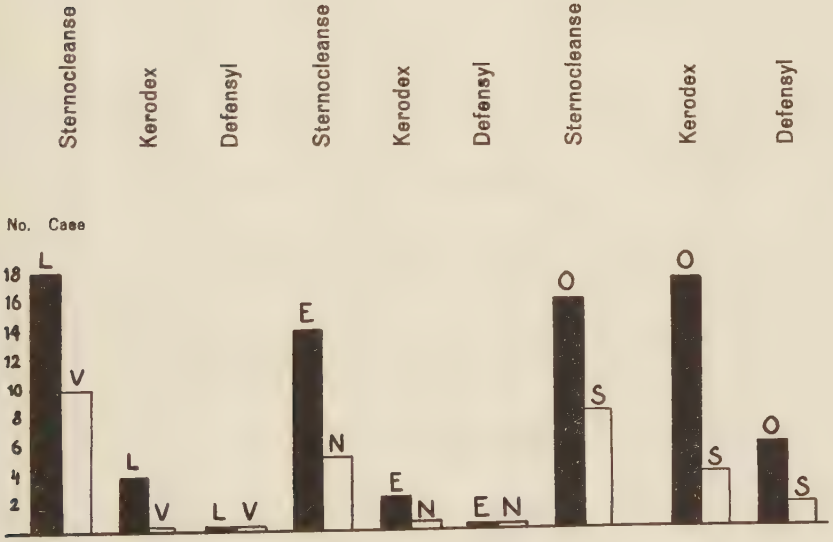
Graph I:	Graph II:	Graph III:
Toxicity of Salves	Toxicity on the specific type of patient	Protectivity of Salves



Legend: L: Patch-test
V: Open patch-test
E: Eczema patients
N: Non-eczema patients
O: Obligatory stimulus
S: Specific Allergen

B. Protective salves against acids, bases, and water-soluble substances

Graph I:	Graph II:	Graph III:
Toxicity of salves	Toxicity on the specific type of patient	Protectivity of Salves



Legend: L: Patch-test
V: Open patch-test
E: Eczema patients
N: Non-eczema patients
O: Obligatory stimulus
S: Specific Allergen

The experiment conducted by massaging the salves into the normal skin for 5 minutes duration two times per day for three days all showed negative results.

RESULTS - STERNOCLEANSE

Pat.	Sternocleanse I		Sternocleanse II		Sternocleanse I + Petroleum			Control Petroleum			Alk. Resist.					Alk. Resist + Sternocleanse				
	closed	open	closed	open	75	50	25	75	50	25	E	S	P	V		E	S	P	V
LV	+±	–	+	–	+±	+	–	++	+	±	2	2	1	–	I	1	–	–	–
1920											2	2	2	2	II	1	1	1	1
M											2	2	2	2	III	1	1	1	1
SW	+	–	–	–	+±	–	–	++	+	±	1	1	–	–	I	1	1	–	–
1911											2	2	1	–	II	2	2	–	–
M											2	2	1	–	III	2	2	–	–
DR	++	–	+	–	–	–	–	++	–	–	–	–	–	–	I	–	–	–	–
1905											–	–	–	–	II	–	–	–	–
M											–	–	–	–	III	–	–	–	–
AF	++	–	–	–	±	–	–	++	+	–	1	1	1	–	I	1	–	–	–
1915											1	1	1	–	II	1	–	–	–
M											1	1	1	–	III	1	–	–	–
LJ	–	–	+	–	–	–	–	–	–	–	–	–	–	–	I	–	–	–	–
1893											–	–	–	–	II	–	–	–	–
M											1	1	1	–	III	1	1	–	–
MR	+	–	–	–	++	++	–	++	++	–	1	1	1	1	I	1	–	–	–
1898											2	2	2	2	II	1	1	1	1
M											3	3	2	2	III	1	1	1	1
OP	++	–	+	–	–	–	–	–	–	–	–	–	–	–	I	–	–	–	–
1924											–	–	–	–	II	–	–	–	–
M											1	1	–	–	III	1	1	–	–
OG	++	–	+	–	–	–	–	±	–	–	1	1	1	1	I	–	–	–	–
1902											1	1	1	1	II	1	–	–	–
M											2	2	2	1	III	2	1	1	1
SE	++	–	+	–	–	–	–	±	–	–	1	1	1	–	I	1	–	–	–
1910											2	2	1	1	II	1	1	–	–
M											3	2	1	1	III	2	1	–	–
RE	++	++	++	+	++	–	–	++	–	–	–	–	–	–	I	–	–	–	–
1884											1	1	–	–	II	1	–	–	–
F											2	1	–	–	III	2	1	–	–
SE	+	–	+	+	+±	–	–	++	–	–	1	1	1	1	I	1	–	–	–
1900											2	2	2	2	II	2	2	2	2
M											2	2	2	2	III	2	2	2	2
WJ	+	+	+	+	+	–	–	++	–	–	1	1	1	1	I	1	–	–	–
1907											2	2	2	2	II	2	1	1	1
M											3	3	3	3	III	2	2	2	2
BA	+	–	+	–	–	–	–	–	–	–	–	–	–	–	I	–	–	–	–
1919											–	–	–	–	II	–	–	–	–
M											1	1	–	–	III	1	1	–	–
LM	+	–	+	–	++	–	–	++	–	–	1	1	1	1	I	–	–	–	–
1933											2	2	2	2	II	1	1	1	1
M											2	2	2	2	III	1	1	1	1
BL	+	–	+	–	++	+	–	++	+	–	1	–	–	–	I	–	–	–	–
1883											2	–	–	–	II	1	–	–	–
F											2	–	–	–	III	1	–	–	–

	Sternocleanse I		Sternocleanse II		Sternocleanse I + Petroleum			Control Petroleum			Alk. Resist.		Alk. Resist. + Sternocleanse II
	closed	open	closed	open	75	50	25	75	50	25	E S P V		E S P V
A 14	+	–	+	–	±	–	–	++	±	–	– – – – 1 – – – 2 – – –	I II III	– – – – – – – – 1 – – –
V 11	+	–	+	–	–	–	–	++	–	–	1 – – – 2 1 1 1 2 2 2 2	I II III	1 – – – 1 1 1 – 1 1 1 1
. 05	+	–	++	+	–	–	–	+		–	1 1 1 1 2 1 1 1 2 2 2 2	I II III	1 – – – 1 – – – 1 1 – –
G 04	+	–	±	±	+	–	–	+		–	1 – – – 1 – – – 2 – – –	I II III	1 1 – – 2 2 1 1 2 2 2 1
M 07	+	–	–	–	–	–	–	++	–	–	– – – – – – – – 1 – – –	I II III	– – – – – – – – – – – –
P 30	+	–	+	–	–	–	–	–	–	–	1 – – – 1 – – – 1 – – –	I II III	– – – – 1 – – – 1 – – –
V 25	–	–	+	–	+	–	–	+		–	1 1 – – 2 2 1 1 2 2 1 1	I II III	– – – – 1 1 1 – 1 1 1 –
. 92	–	–	±	–	++	–	–	++	–	–	– – – – 1 – – – 1 – – –	I II III	– – – – 1 – – – 1 – – –
. 16	++	–	+	–	+	–	–	+	–	–	– – – – – – – – 1 – – –	I II III	– – – – – – – – – – – –
G 31	+	–	–	–	++	+	±	++	+	±	– – – – 1 – – – 1 – – –	I II III	– – – – 1 – – – 1 – – –
. 37	++	–	+	–	+	–	–	+	–	–	– – – – – – – – 2 – – –	I II III	– – – – 1 – – – 1 – – –
. 4	++	–	+	–	–	–	–	++	+	+	– – – – – – – – 1 – – –	I II III	– – – – – – – – 1 – – –
. 5	+	–	–	–	±	–	–	±	–	–	– – – – – – – – 1 – – –	I II III	– – – – – – – – – – – –
1	+	–	–	–	++	+	–	++	+	–	– – – – 1 – – – 1 1 – –	I II III	– – – – – – – – – – – –
. 2	+	–	+	–	–	–	–	–	–	–	1 – – – 2 1 1 – 3 2 2 1	I II III	– – – – 1 1 – – 1 1 – –

Legend: E = Erythema
S = Swelling
V = Vescicula
P = Papula

RESULTS - KERODEX

Pat.	Kerodex 5		Kerodex 1		Kerodex 5 + Petroleum			Control Petroleum			Alk. Resist.		Alk. Resist. + Kerodex	
	closed	open	closed	open	75	50	25	75	50	25	E S P V		E S P V	
BE 1898 F	−	−	−	−	−	−	−	++	−	−	− − − −	I	− − − −	
											− − − −	II	− − − −	
											1 1 − −	III	1 1 − −	
DK 1915 F	−	−	+	−	++	±	−	++	+	−	1 1 1 −	I	1 − − −	
											2 2 2 −	II	1 1 1 −	
											2 2 2 −	III	1 1 1 −	
FM 1908 M	++	−	−	−	−	−	−	++	±	±	− − − −	I	− − − −	
											1 1 − −	II	− − − −	
											1 1 − −	III	− − − −	
JF 1916 M	+	−	++	−	−	−	−	++	±	−	1 − − −	I	− − − −	
											1 − − −	II	− − − −	
											1 − − −	III	− − − −	
KB 1899 F	+	−	−	−	+	−	−	++	±	−	1 1 − −	I	− − − −	
											1 1 − −	II	− − − −	
											2 1 − −	III	1 − − −	
RF 1931 M	+	−	−	−	+	−	−	++	±	−	1 1 − −	I	− − − −	
											1 1 1 −	II	− − − −	
											2 1 1 1	III	− − − −	
PR 1934 M	++	−	−	−	++	−	−	++	−	−	− − − −	I	− − − −	
											− − − −	II	− − − −	
											1 − − −	III	2 1 1 −	
FE 1924 F	+	−	−	−	−	−	−	++	+	−	1 − − −	I	− − − −	
											2 1 1 1	II	− − − −	
											3 2 1 1	III	1 1 1 1	
CJ 1909 M	−	−	−	−	+	−	−	++	+	−	2 1 − −	I	1 − − −	
											2 1 1 1	II	1 − − −	
											2 2 1 1	III	1 1 1 1	
LF 1895 M	+	−	−	−	+	−	−	++	−	−	− − − −	I	− − − −	
											1 1 1 −	II	− − − −	
											2 2 2 −	III	1 1 − −	
GS 1894 M	−	−	−	−	+	−	−	+	−	−	− − − −	I	− − − −	
											− − − −	II	− − − −	
											1 1 − −	III	1 1 − −	
SH 1898 M	+	−	−	−	++	±	±	++	+	±	− − − −	I	− − − −	
											− − − −	II	− − − −	
											− − − −	III	− − − −	
KF 1899 M	++	−	−	−	++	−	−	++	−	−	1 1 1 −	I	− − − −	
											2 2 1 1	II	1 1 − −	
											3 2 2 1	III	1 1 1 1	
BA 1903 M	+	−	−	−	−	−	−	++	−	−	1 − − −	I	1 − − −	
											2 2 2 2	II	2 1 1 1	
											2 2 2 2	III	2 1 1 1	
MO 1904 F	+	−	−	−	−	−	−	−	−	−	− − − −	I	− − − −	
											1 1 1 −	II	1 − − −	
											2 2 2 1	III	1 − − −	

	Kerodex 5		Kerodex 1		Kerodex 5 + Petroleum			Control Petroleum			Alk. Resist.					Alk. Resist. + Kerodex 1				
	closed	open	closed	open	75	50	25	75	50	25		E	S	P	V		E	S	P	V
	++	–	++	–	+	–	–	++	–	–		2	1	1	1	I	1	1	1	1
												2	1	1	1	II	1	1	1	1
												2	1	1	1	III	1	1	1	1
	+	–	–	–	+	+	–	++	+	±		–	–	–	–	I	–	–	–	–
												2	2	1	–	II	1	1	1	–
												2	2	1	–	III	1	1	1	–
	++	–	–	–	+	+	–	+	±	–		–	–	–	–	I	–	–	–	–
												2	2	2	–	II	1	–	–	–
												3	1	1	–	III	1	1	1	–
	–	–	–	–	++	–	–	++	–	–		–	–	–	–	I	–	–	–	–
												1	1	1	1	II	1	1	1	1
												2	2	2	2	III	2	2	2	2
	+	+	–	–	++	–	–	++	±	–		–	–	–	–	I	–	–	–	–
												1	–	–	–	II	–	–	–	–
												1	1	–	–	III	1	1	–	–
	+	–	–	–	+	–	–	++	–	–		–	–	–	–	I	–	–	–	–
												–	–	–	–	II	–	–	–	–
												1	–	–	–	III	1	–	–	–
	–	–	+	–	+	–	–	++	++	±		2	2	1	–	I	1	1	1	–
												2	2	2	2	II	1	1	1	1
												3	2	2	2	III	1	1	1	1
	++	–	–	–	+	–	–	+	±	–		–	–	–	–	I	–	–	–	–
												1	–	–	–	II	1	1	–	–
												1	1	–	–	III	1	1	–	–
	++	–	–	–	++	±	–	++	+	–		1	1	–	–	I	1	–	–	–
												1	1	–	–	II	1	–	–	–
												2	1	1	1	III	1	–	–	–
	+	–	–	–	+	–	–	+	–	–		1	1	–	–	I	–	–	–	–
												2	2	–	–	II	1	1	–	–
												2	2	1	–	III	1	1	–	–
	–	–	–	–	+	–	–	++	–	–		1	–	–	–	I	–	–	–	–
												1	1	1	–	II	–	–	–	–
												1	1	1	–	III	1	–	–	–
	++	–	–	–	–	–	–	++	–	–		–	–	–	–	I	–	–	–	–
												1	–	–	–	II	–	–	–	–
												1	1	–	–	III	–	–	–	–
	–	–	–	–	–	–	–	++	–	–		1	1	1	1	I	1	1	1	1
												2	1	1	1	II	2	2	1	1
												3	3	2	1	III	3	2	2	2
	+	–	–	–	++	+	–	++	+	–		1	–	–	–	I	–	–	–	–
												2	2	1	–	II	1	1	–	–
												2	2	1	1	III	2	1	1	1

Legend: E = Erythema
S = Swelling
P = Papula
V = Vescicula

RESULTS - DEFENSYL

Pat.	Defensyl F		Defensyl W		Defensyl F + Petroleum			Control Petroleum			Alk. Resist.					Alk. Resi + Defensyl			
	closed	open	closed	open	75	50	25	75	50	25		E	S	P	V		E	S	P
SH	–	–	–	–	++	±	±	++	±	±		–	–	–	–	I	–	–	–
1898												–	–	–	–	II	–	–	–
M												–	–	–	–	III	–	–	–
KF	–	–	–	–	++	–	–	++	–	–		1	1	1	–	I	1	1	–
1899												2	2	1	1	II	2	1	–
M												3	2	2	1	III	2	2	1
BA	–	–	–	–	++	–	–	++	–	–		1	–	–	–	I	–	–	–
1903												2	2	2	2	II	2	1	1
M												2	2	2	2	III	2	2	2
MO	–	–	–	–	–	–	–	–	–	–		–	–	–	–	I	–	–	–
1904												1	1	1	–	II	1	1	–
M												2	2	2	1	III	2	2	1
FJ	–	–	–	–	++	–	–	++	–	–		2	1	1	1	I	–	–	–
1902												2	1	1	1	II	–	–	–
M												2	1	1	1	III	1	1	–
SF	–	–	–	–	–	–	–	++	+	±		–	–	–	–	I	–	–	–
1893												2	2	1	–	II	2	2	1
M												2	2	1	–	III	2	2	1
ZJ	–	–	–	–	–	–	–	+	±	–		–	–	–	–	I	–	–	–
1896												1	–	–	–	II	–	–	–
M												2	1	1	–	III	1	1	1
RH	–	–	–	–	++	–	–	++	–	–		–	–	–	–	I	–	–	–
1905												1	1	1	1	II	1	1	–
F												2	2	2	2	III	2	1	–
M	–	–	–	–	+	–	–	+	–	–		–	–	–	–	I	–	–	–
BG												2	2	1	–	II	–	–	–
1914												2	2	2	1	III	1	1	–
M	–	–	–	–	+	–	–	++	±	–		–	–	–	–	I	–	–	–
SA												1	1	–	–	II	–	–	–
1916												1	1	–	–	III	1	–	–
M	–	–	–	–	++	–	–	++	–	–		–	–	–	–	I	–	–	–
BE												–	–	–	–	II	–	–	–
1898												1	1	–	–	III	1	–	–
DK	–	–	–	–	++	±	–	++	+	–		1	1	1	–	I	–	–	–
1915												2	2	2	1	II	–	–	–
F												2	2	2	1	III	1	1	1
FM	–	–	–	–	–	–	–	++	±	±		–	–	–	–	I	–	–	–
1908												1	1	–	–	II	1	1	–
M												1	1	–	–	III	1	1	–
JF	–	–	–	–	++	–	–	++	±	–		1	–	–	–	I	–	–	–
1916												1	–	–	–	II	–	–	–
M												1	–	–	–	III	1	–	–
KB	–	–	–	–	++	–	–	++	±	–		1	1	–	–	I	1	–	–
1899												1	1	–	–	II	1	1	–
F												2	1	–	–	III	1	1	–

Defensyl F		Defensyl W		Defensyl F + Petroleum			Control Petroleum			Alk. Resist.		Alk. Resist. + Defensyl W
closed	open	closed	open	75	50	25	75	50	25	E S P V		E S P V
–	–	–	–	+	–	–	++	±	–	1 1 – –	I	– – – –
										1 1 1 –	II	– – – –
										2 1 1 1	III	1 1 – –
–	–	–	–	++	–	–	++	–	–	– – – –	I	– – – –
										– – – –	II	– – – –
										1 – – –	III	– – – –
–	–	–	–	++	±	–	++	+	–	1 – – –	I	– – – –
										2 1 1 1	II	1 – – –
										3 2 1 1	III	1 1 – –
–	–	–	–	++	+	–	++	+	–	1 1 – –	I	– – – –
										2 1 1 1	II	– – – –
										2 2 1 1	III	1 – – –
–	–	–	–	++	–	–	++	–	–	– – – –	I	– – – –
										1 1 1 –	II	1 1 – –
										2 2 2 –	III	2 2 – –
–	–	–	–	–	–	–	+	–	–	– – – –	I	– – – –
										– – – –	II	– – – –
										1 1 – –	III	1 1 – –
–	–	–	–	++	–	–	++	–	–	– – – –	I	– – – –
										1 1 – –	II	1 – – –
										1 1 – –	III	1 1 – –
–	–	–	–	+	–	–	++	++	±	2 2 1 –	I	– – – –
										2 2 2 2	II	– – – –
										3 2 2 2	III	2 1 1 –
–	–	–	–	+	–	–	+	±	–	– – – –	I	– – – –
										1 – – –	II	– – – –
										1 1 – –	III	1 1 – –
–	–	–	–	++	±	–	++	+	–	1 1 – –	I	– – – –
										1 1 – –	II	1 1 1 –
										2 1 1 1	III	1 1 1 1
–	–	–	–	++	–	–	++	–	–	1 1 1 1	I	1 1 1 1
										2 1 1 1	II	1 1 1 1
										3 3 2 1	III	2 2 1 1
–	–	–	–	+	–	–	+	–	–	1 1 – –	I	– – – –
										2 2 – –	II	1 1 1 1
										2 2 1 –	III	1 1 1 1
–	–	–	–	++	–	–	++	–	–	1 – – –	I	1 – – –
										1 1 – –	II	1 – – –
										1 1 – –	III	1 – – –
–	–	–	–	+	±	–	+	±	–	– – – –	I	– – – –
										1 1 – –	II	1 – – –
										2 2 1 –	III	1 1 1 –
–	–	–	–	++	–	–	++	–	–	– – – –	I	– – – –
										– – – –	II	1 – – –
										1 – – –	III	1 – – –

Legend: E = Erythema
S = Swelling
P = Papula
V = Vescicula

Methods — Part II:

Patch-tests of Sternocleanse and Kerodex having showed a definite toxicity, experiments were undertaken with Sternocleanse I in order to determine the toxic substance and to apply the results to Sternocleanse II and Kerodex 1 and 5.

A. Samples of the salves of Sternocleanse I, Kerodex 5, and Defensyl F were evaporated für 24 hours in the incubator.

Patch-tests on 5 patients were made of the original salve, the evaporated residue, and an open patch-test was made of the evaporated residue.

B. Four extractions of Sternocleanse I were separated by means of the following method. Aqua dest. was added to 100 gms. of the salve to reach a totale volume of 300 cm^2. Ether was added which resulted in the solution being divided into 3 layers. The top layer was a red ether layer containing the ether soluble substances, the middle layer contained the water soluble substances, and the bottom layer contained the solid undissolved substances. The layers ware separated. The water layer was saturated with sodium chloride an a soft soap mixture was precipitated which was separated. The extractions were brought to correspond to 100 cm^2 which attempted to equalize the quantity of substance in the extractions with the quantity of substance in the original salve.

The four fractions obtained were:

(1) ether extraction
(2) sediment extraction
(3) soft soap extraction
(4) water extraction.

The four extractions were converted to a salve by combining them with Unguentum cetylicum.

The salves obtained were:

(1)	ether extraction	1
	ungt. cetyl	4
(2)	sediment extraction	
	ungt. cetyl.	
		ana
(3)	soft soap extraction	
	ungt. cetyl.	
		ana
(4)	water extraction	4
	ungt. cetyl.	6

Patch-tests and open patch-tests on 15 patients were conducted using Sternocleanse I, the salves of the four extractions, and a 25 % soft soap preparation in Ungt. cetyl. (Sapo kalinus).

Alkali Resistance-tests (Burckhardt) were done on each of the patients.

Results — Part II:

A. The results of the patch-tests of the salves Sternocleanse I, Kerodex 5, and Defensyl F, the patch-tests of their evaporated residues and the open patch-test of the evaporated residues on 5 patients show as seen in Table C an apparent correlation between the positive patch-tests of the original salves and the positive patch-tests of their evaporated residues. The open patch-tests of the evaporated residues were negative.

Corresponding positive patch-tests on a patient included (i. e. Sternocleanse I and the evaporated residue of Sternocleanse I) approximately equal morphology, extent of skin area effected, and time of appearance and disappearance of a positive reaction (appeared in 24 hrs. and usually the redness disappeared in 2—3 days). The same criterion was applied in Part II - B.

Patient	Salve	Patch-test of original salve	Patch-test of evaporated residue	Open patch-test of evaporated residue
I	Sternocleanse	+	+	—
	Kerodex	+	+	—
	Defensyl	—	—	—
II	Sternocleanse	+	+	—
	Kerodex	+	+	—
	Defensyl	—	—	—
III	Sternocleanse	—	—	—
	Kerodex	—	—	—
	Defensyl	—	—	—
IV	Sternocleanse	+	+	—
	Kerodex	—	—	—
	Defensyl	—	—	—
V	Sternocleanse	+	+	—
	Kerodex	+	+	—
	Defensyl	—	—	—

Table C

B. The pach-tests and open patch-tests of Sternocleanse I, its four extractions, and the 25 % soft soap on 15 patients (Table D) show

an apparent correlation in 9,0 patients between the positives of the patch-tests of Sternocleanse I, extraction 3, and the 25 % soft soap salve. The patch-tests of the extractions 1, 2, and 4 were negative except in one patient.

The open patch-tests of Sternocleanse I, the four extractions and the 25 % soft soap salve were only sporadically positive in the tests with Sternocleanse I and extraction 3. The soft soap was continually negative.

Patient	Sternocleanse		Extraction 1		Extraction 2		Extraction 3		Extraction 4		Soft soap 25%	
	open	closed	open	closed	open	closed	open	closed	open	closed	open	closed
1	–	+	–	–	–	–	–	+	–	–	–	–
2	–	+	–	–	–	–	–	+	–	–	–	–
3	–	+	–	–	–	–	+	+	–	–	–	+
4	–	+	–	–	–	–	–	–	–	–	–	–
5	–	–	–	–	–	–	–	–	–	–	–	–
6	+	+	–	–	–	–	+	+	–	–	–	+
7	–	+	–	–	–	–	+	+	–	–	–	+
8	+	+	–	–	–	–	+	+	–	–	–	+
9	–	+	–	+	–	–	+	+	–	–	–	+
10	–	+	–	–	–	–	–	+	–	–	–	+
11	–	+	–	–	–	–	–	+	–	–	–	+
12	–	+	–	–	–	–	+	+	–	–	–	+
13	–	+	–	–	–	–	–	+	–	–	–	+
14	–	–	–	–	–	–	–	–	–	–	–	–
15	–	–	–	–	–	–	–	–	–	–	–	–

Table D

The alkali resistance test showed no apparent correlation between a decreased alkali resistance and the positive patch-tests of Sternocleanse I, extraction 3, and the 25 % soft soap salve.

Conclusions

The questions posed in the introduction will be discussed.

(I) Do the industrial protective skin creams (Sternocleanse, Kerodex, Defensyl) protect against the harmful substances used in industry so that no pathological skin manifestations occur?

A. Graph III shows that of the three protective salves tested against fats and fat-soluble substances Kerodex No. 5 has a greater protectivity effect against the obligatory stimulus petroleum and the specific exogenous allergen of a patient. This effect against the obli-

gatory stimulus protected 16 patients out of 30 for Kerodex no. 5, 12 patients for Sternocleanse I, and 7 patients for Defensyl F. The protectivity against the specific exogenous allergen for the 3 salves are practically parallel to the graphs of the obligatory stimulus. Immediately, one sees that Defensyl F protects approximately one-half as much as Kerodex No. 5.

B. Graph III points out the effect of the salves against water-soluble substances. Kerodex No. 1 with a protectivity against the obligatory stimulus of N/2 NaOH of 18 patients out of 30 and Sternocleanse II with a protectivity of 17 patients were almost equal in effect. Defensyl W demonstrated a 7 patients protectivity effect which is less than one-half the effect of either Kerodex No. 1 or Sternocleanse II. The curves of the protectivity against the specific exogenous allergen do not correlate as well as that in A, Graph III.

The hights of the graphs of protectivity against external irritants do not extend over 18 patients which appears on the surface to be a poor safety measure against toxicogenic substances (see discussion below).

(II) Are the industrial protective creams, Sternocleanse, Kerodex and Defensyl harmful to the user?

Examining A, Graph I and II which deals with the salves against fats and fat-soluble substances, one sees that a toxic reaction is obtained in over 70 % of cases by patch-testing the salves of Sternocleanse I and Kerodex No. 5. Defensyl F did not demonstrate a toxic effect on the skin in the same experiments. A, Graph II shows that Sternocleanse I and Kerodex No. 5 have a less toxic effect on non-eczematous cases than on eczematous cases which pointed out the greater sensitivity of eczema patients to external irritants. Sternocleanse I has a difference of 2 patients in the eczematous cases effected by the patch-test and the non-eczematous cases effected. Kerodex has a difference of 5. The patch-test of Kerodex No. 5 has a less toxic effect on non-eczematous people than Sternocleanse I. Both salves have an approximately equal effect on eczematous patients demonstrating that an sensitized patient (eczema patient) may react to other unrelated substances similarly.

B, Graph I infers the toxicity of Sternocleanse II and Kerodex No. 1 which protect against water-soluble irritants. Sternocleanse II showed 19 patients toxic and Kerodex No. 1 showed 4 patients toxic. Defensyl W did not show toxicity.

The greatest toxic effect of Sternocleanse II was mainly on the eczematous cases. Of the eczematous cases, 14 showed manifestations of toxicity to a patch-test and 5 of the non-exzematous patients

reacted. Kerodex No. 1 effected 4 of the eczema patients and none of the non-eczematous cases. This illustration points out again the greater acquired sensitivity of eczema cases to external influence.

The open patch-tests which allow exposure of the salves to air show in A and B Graph I a significant diminishing of toxicity of Sternocleanse I and II and Kerodex No. 5 and No. 1. The conditions of the patch-tests and open patch-tests are the same except for the air exposure. Apparently, the closed patch-test permits a condition to exist which faciliates a reaction between the salve and the skin.

Theoretically, the toxicogenic substance seen in Part I appears to be volatile and may be deduced from a thorough search of the literature.

As previously mentioned, the constituents of Sternocleanse are known, but the concentrations of the individual substances are unknown to the writer. Sternocleanse containes: soap flakes, talc, fatty acids, glycerine, sorbitol, water, two perfumes, parachlormetacresol, and Biebrich scarlet. The soap flakes are usually potassium (K), sodium (Na), ammonium (NH_4) or amine salts of fatty acids with a 12—18 carbon (C) atoms and this usually has little effect unless the alkali quantity present effects the buffer ability of the skin. Talc is used in many salves to change its consistency, and it does not react with the skin unless the refining of the talc is in error and large pieces are present. Fatty acids produce an idiosyncrasy very rarely (Bonnevie). Glycerine and sorbitol in 75 % concentrations may be irritants by means of their osmotic properties. Perfumes contain the volatile oils pinene and limonene which may have an irritating effect on the skin. Czetsch-Lindenwald says that perfumes in salves cause in many cases irritations on healthy skin and this increases in sick areas. They further write that almost all volatile oils in salves by long use will produce an allergy. Parachlormetacresol does in many cases produce an eczema (Bonnevie). He stresses that all phenols cause local irritations and all have the ability to cause a certain sensitization. Biebrich scarlet used in medicinal salves for healing of wounds has no irritating effects on skin. Therefore theoretically the likeliest substances present in Sternocleanse causing the toxic reaction of the salve are parachlormetacresol and the perfumes; perhaps the glycerine and sorbitol.

On the basis of the experiments conducted in Part II, one may assume that the toxic substance is not a volatile substance. Part II A shows an apparent parallel action of the patch-tests of the original salves and the evaporated residues of the salves which may rule out the theorized toxic volatile substance. Part II B demonstrates corresponding patch-test positives of Sternocleanse I, the soft soap ex-

traction, and the 25 % soft soap salve. These positives were morphologically similar and appeared and disappeared at approximately the same times. The tests of the remaining extractions were negative except in one case. This may indicate that the harmful substance in Sternocleanse I is a soap.

The discordant results between the patch-test and the open patch-test appear to be due to the closed system of the patch-test which prevents normal skin function in the patch area and facilitates a reaction between exogenous substances applied on the closed patch and the skin.

The process occurring under the closed patch-test between the salve and the skin may simulate the reaction seen in the test tube during the isolation of the soap extraction (extraction 3). The soap extraction was obtained by saturating the water extraction with sodium chloride. The result was a precipitation of a soap like substance(s) which was separated. This substance has a toxic effect on patients as demonstrated in Part II B.

Analogous to the soap extraction, the process unter the closed patch containing salve may be identical. The conditions of the closed patch do not permit evaporation which allows a moist chamber to exist under the patch. This plus the imprisonment under the patch of exretory substances from the skin which includes sodium chloride contained in sweat may create a milieu able to precipitate the soap from the salve on to the skin. The various substances present may macerate the skin and allow the soap to have its toxic effect.

The precipitation of soap in the extraction method and on the skin may be due to the process of saponification which is the hydrolysis of fats by using an alkali. Sodium chloride may have provided the active cation and Sternocleanse I the basic environment plus fats (app. pH8 instead of pH6). The type formula for such a reaction may be:

$$\underset{\text{Stearin}}{C_3H_5(O.CO.C_{17}H_{35})_3} + 3\,NaOH \rightarrow \underset{\substack{\text{Sodium stearate}\\(\text{A soap})}}{3C_{17}H_{35}COONa} + \underset{\text{Glycerol}}{C_3H_5(OH)_3}$$

The sporadic open patch-test positives were predominantly of extraction 3 which has a concentration of 50 %. The soft soap salve was of a lower concentration (25 %) and causes no positive open patch-tests. This may explain the difference in the open patch-test results.

If conducted over a longer period of time, perhaps the experiment conducted massaging the salve into the skin two times per day may prove positive with Sternocleanse. This investigation more closely

simulates actual conditions of use in industry. The concentration of the salve per unit area is the least in this method.

The patch-test itself does not simulate the real use of a salve by a consumer. This method is a more stringent means of examining a substance and the results obtained may correspond to several months of actual use of the salve. Since the patch-test of the salve is not the method of actual application of the salve in industry, since the relationship of the salve, skin, and air are entirely different in the patch-test and actual use in industry, and since the results of industry using the salves are excellent, a conclusion censuring the harmful qualities of the salves can not be drawn. Recommendations to workers sensitive to the salve may prove of value.

The open patch-test resembles more closely the use of a salve in industry than the closed patch-test. This test shows less toxic reactions.

The ideal test allied very closely to the use of a salve in industry is the message test which did not show toxic reactions.

An attempt was made to prove the theory that the quantity of sweat of the person using the salve plays a large part in the degree of manifestation of the toxic reaction. Two cubic centimeters of Pilocarpin were injected subcutaneously into 5 test patients after applying the closed patch-test with Sternocleanse I. The patch was removed after 24 hours. The results were: (1) 3 patients who previously showed mild reactions demonstrated exceedingly strong reactions, (2) 1 patient who was negative previously showed a mild reaction, (3) 1 patient was negative.

Apparently the quantity of salve and the length of time the salve is applied to the skin by means of the patch-test, determines the skin manifestation. Patch-tests removed after 48 hours showed on the whole weaker reactions than those removed after 24 hours. This indicates that the limited amount of toxic substance in the salve was utilized immediately leaving an insufficient amount to cause a furthur reaction and thus permitting the skin to heal.

(III) Have the protective skin salves a place in industry as determined from the experimental investigation?

Industrial skin salves should not be discarded. They do play an important role in that they force a program of personal hygiene on the worker (washing after work, changing cloths, etc.). Also, the salves do have a protective effect against external irritants. There appears to be a direct relationship of the degree of toxicity in the patch-test and the amount of protectivity in the patch-test. As the protectivity lessens the toxicity of the salve lessens. Defensyl is not toxic but it

also shows the least protectivity of the three barrier creams tested. Carrié recommends that only the important base of the salves be used. He states that the protective effect of the salves are not greater than the bases used in the creams themselves. However according to this work, the desireable protective effect appears greater depending on the composition of the barrier cream added to the base.

Summary

A testing of three industrial protective skin creams Sternocleanse, Kerodex, and Defensyl was conducted on patients in the Dermatological Clinic of the Inselspital, Bern.

Three questions were posed:

(1) Do these salves prevent skin manifestations caused by materials used in industry?

(2) Are these salves harmful to the user?

(3) Have the protective skin salves a place in industry as determined from the experimental investigation.

Using the dermatological methods, patch-test, open patch-test, Burckhardt's Alkali resistance test, and a massage test, the conclusion was obtained that:

(1) The salves, Sternocleanse and Kerodex, prevent skin manifestations against an obligatory irritant in ca. 50 % of patients.

(2) Sternocleanse and Kerodex caused toxicity reactions on many patients. Defensyl had no irritating effect on patients.

(3) Protective skin salves should not be abandoned on the basis of this work. The methods used in obtaining the toxic results did not simulate actual use in industry. Only recommendations to decrease the soap content of the salves, and warning that a worker may become sensitive to the salve may be permitted. Salves play an important role in promoting the personal hygiene of the worker (washing), and they also offer a degree of protection against external irritants.

The open patch-test more closely simulates the actual use in industry of protective salves.

The method of application of the salve by the open patch-test is more stringent than the actual use of the salve in industry but less stringent than the closed patch-test. Therefore, more consideration should be placed on the results of the open patch-tests than on the closed patch-tests. These results of the open patch-tests showed considerably less harmful reactions than the closed patch-tests.

Acknowledgements

It is a pleasant obligation to express my indebtedness to those who have been helpful to me in the preparation of this dissertation. To Prof. Dr. med. H. KUSKE, I am grateful for his excellent advice and guidance throughout my work: to Dr. med. K. SCHWARZ, I am grateful for his guidance in my clinical experimentation : and to the assistants and nurses in the Dermatological Clinic Inselspital, Bern, for their contributions and help.

Bibliography

Bering, F. and Zitzke, E.: Berufliche Hautkrankheiten, Leipzig 1935

Bonnevie, P.: Aetiologie und Pathogenese der Ekzemkrankheiten, Leipzig 1939

Böstrom, G.: Acta dermato-vener. (Stockholm), 20, 650—662 (1939) (Hypersensitivity Tests in Professional Ekzema, their Applicability and Sources of Error).

Burckhardt, W.: Aerztl. Monatshefte. Sept. 1945 (Das Gewerbeekzem)

Bzowski, M. and Navarre, Ph.: Ann. Hyg. publ. N.S. 14, 230—233 (1936) (Bemerkungen über Hautschädigung beruflichen Ursprungs)

Carrié, C.: Praktischer Leitfaden der Beruflichen Hautkrankheiten. Stuttgart 1951

Carrié, C. and Lotz, G.: Dermat. Wschr. 126, 855—860 (1952)

Cruickschrank: Brit. med. J. 5, 205 (1948)

Cumming, W., Cameron, Cumming, E., Macraild: Brit. J. of Indust. Med. 4, 327, 1947 («Barrier Creams and their Evaluation»)

Curschmann, F.: Archiv. f. Dermat. 173, 222, 1935 («Vorkommen, Entstehung und Verhütung beruflicher Hauterkrankungen»)

Czetsch-Lindenwald, H. v.: Salben, Puder, Externa. Berlin 1944

Czetsch-Lindenwald and Schmidt-La Baume, F.: Salben und Salbengrundlagen, Berlin 1939

Findenrath: Zbl. f. Gewerbehyg. 14, 206 (1937)

Gougerot, H. and Carteaud, A.: Dermatoses Professionelles, Paris 1952

Harrow, B.: Textbook of Biochemistry, Philadelphia 1950

Högger, D.: Aerzt. Monatshefte Sept. 1945 (Zur Prophylaxe der berufsbedingten Hautkrankheiten)

Hopf, G.: Arch. f. Dermat. 181, 204—211 (1940)

Hopf, G.: (Ueber Gewerbeschutzsalben). Therapie der Gegenwart 83, 87—92 (1942) (Theorie und Praxis der Gewerbeschutzsalben)

James, A. P. R.: Archiv. of Dermat. 30 July 1934 («An Aid in the Management of Occupational Contact Dermatitis»)

Klauder, J. V., Gross, E. R., and Brown, H.: Arch. for Dermat. 41, 331—358 (1940) (Prevention of Industrial Dermatitis with Reference to Protective Hand Creams, Soap, and the Harmful Role of some Cleansing Agents)

Koelsch, F.: Handbuch der Berufskrankheiten, Jena 1935

Mac Kenna, R.: Modern Trends in Dermatology, Chapt. 12. London 1948

Marti, P.: Diss. Zürich 1950. (Zur Prophylaxe der Alkalischädigungen der Haut)

Mignolet, F.: Arch. mal. profess. 12, 275—279 (1951) (Peut-on eviter les dermatoses professionelles dans l'industrie?)

Mumford, P. B.: The Practitioner, 288, May 1942 (The Need for Cooperative Thought on Industrial Dermatitis)

Overton, S.: Brit. J. of Dermat. 41, 255, 1929 (Industrial Dermatoses; Causation, Recognition, Prevention, and Treatment)

Sadler, Mariott: Brit. Med. J. 2, 769, Nov. 23, 1946 (The Evaluation of Barrier Creams)
Schuchard, W.: Münchner Medizinische Wochenschrift 91, 467, 1944 (Beitrag zur Verhütung gewerblicher Hauterkrankungen)
Schwartz, L.: Med. Clinics of North Am. 26, 1195, July 1942 (Protective Ointments and Industrial Cleansers)
Schwartz, L., Tulipan, L., and Peck, S.: Occupational Diseases of the Skin. Philadelphia 1947
Schweizerische Unfallversicherung 1945
Stowell, T. E. A.: Medicina del Deporte y del Trabajo. 84, 3008—3011, Dicembre 1949
Tara, S., Cavigneaux, A. and Delplace, Z.: Arch. mal. profess. 12, 641—648 (1951) (Les dermites professionelles et leur prevention)
Witowski, L., Fischer, C., and Murdock, H. D.: JAMA 1942, 1406